

## WINTER MOVEMENTS OF ADULT NORTHERN GOSHAWKS THAT NESTED IN SOUTHCENTRAL WYOMING

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**ABSTRACT.**—Winter movements of four adult northern goshawks (*Accipiter gentilis*) that nest in south-central Wyoming were monitored during the winter of 1992–93. Goshawks initiated fall migrations in early fall (primarily mid-September) while weather conditions are moderate. Female 1 migrated 185 km south of her nest. She wintered in a mountainous area in Colorado at a higher elevation (2774 m) than her nest site (2500 m elevation). Male 1 migrated approximately 65 km west southwest of his nest before he was killed by a hard blow from a blunt object. This strike may have been caused by another raptor or a collision with the ground. Both Female 2 and Male 2 migrated in a southerly direction from their nests. They were located approximately 140 km and 70 km, respectively, from their nests before both birds were lost during inclement weather. All birds returned to their nests from wintering areas between 23 March to 12 April. Results from this study suggest to wildlife managers that some goshawk populations in the Rocky Mountains are migratory; efforts to manage this species need to consider both wintering and nesting habitat requirements.

**KEY WORDS:** *Accipiter gentilis*; Colorado; northern goshawk; winter movements; Wyoming.

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Movimientos invernales de adultos de *Accipiter gentilis* que nidifican en el centrosur de Wyoming

**RESUMEN.**—Se monitorearon los movimientos de invierno de cuatro individuos adultos de *Accipiter gentilis* que nidificaron en el centro-sur de Wyoming, durante el invierno de 1992–93. *Accipiter gentilis* inició su migración otoñal tempranamente (a mediados de septiembre) mientras las condiciones climáticas eran moderadas. La hembra 1 migró 185 km al sur de su nido. Ella inveró en un área montañosa en Colorado, a una altitud mayor (2774 m) que el sitio de nidificación (2500 m). El macho 1 migró aproximadamente 65 km al oeste sur-oeste de su nido antes de ser muerto al sufrir un duro golpe. Esta muerte pudo ser causada por otra rapaz o por una colisión con el suelo. Tanto la hembra 2 como el macho 2 migraron en dirección al sur, desde sus nidos. Ellos fueron localizados aproximadamente a 140 km y 70 km, respectivamente; luego de condiciones climáticas desfavorables se perdió el rastro de ambos individuos. Todas las aves retornaron a sus áreas de nidificación entre el 23 de marzo y el 12 de abril. Los resultados de este estudio sugieren a los especialistas en manejo de vida silvestre que algunas poblaciones de *A. gentilis* en las Montañas Rocosas son migratorias; los esfuerzos necesarios para el manejo de esta especie deben considerar requerimientos de hábitat invernal y reproductivos.

[Traducción de Ivan Lazo]

Winter movements of northern goshawks (*Accipiter gentilis*) are poorly understood. Studies of goshawk migration in North America are limited (Doerr and Enderson 1965, Alaska Dept. of Fish and Game 1993). The limited knowledge that is available is based mostly on European studies (Opdam et al. 1977, Kenward et al. 1981, Marcström and Kenward 1981, Widén 1985, 1987, 1989). Those studies investigated a different subspecies of goshawk (*A. g. gentilis*) that lives in the human-dominated landscapes of Europe, and their applicability to goshawks wintering in the Rocky Mountains is unknown. During 1992, we studied the winter movements of goshawks that nest in southcentral Wyoming.

### STUDY SITE AND METHODS

We trapped five (three females, two males) nesting adult goshawks and fitted each bird with a backpack radiotransmitter (25.5 g). Each bird was from a different pair. One female's transmitter failed soon after she began her fall movements. The nest territories of all birds were located on the Medicine Bow National Forest in the Sierra Madre Mountains (1981–3366 m elevation) in southcentral Wyoming. Lodgepole pine (*Pinus contorta*) with scattered quaking aspen stands (*Populus tremuloides*) is the dominant forest type at lower elevations (2300–2600 m) whereas subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) are dominant at higher (2438–3505 m) elevations (Alexander et al. 1986, Marston and Clarendon 1988). Sagebrush (*Artemisia* spp.)-grassland prairies surround forested lands. The vegetative composition of this

area is described in detail in Alexander et al. (1986). The climate on the study area is montane with precipitation ranging from 81 cm at 2440 m to 122 cm at 3350 m (Marston and Clarendon 1988). At lower elevations approximately 50% of precipitation is snowfall compared to 75% at higher elevations.

Nesting birds were trapped using a live great horned owl (*Bubo virginianus*) as a lure with a dho-gaza erected within 1 m of the lure (Beebe and Webster 1976, Rosenfield and Bielefeldt 1993). Goshawk movements were monitored from fixed-wing aircraft. Radio signals were detected using a scanning receiver (Telonics, Mesa, AZ) with antennas mounted on each wing. Flights were conducted an average of 3.5 d apart ( $N = 38$  interflight times, range 1–10 d) between 18 August through 24 December; they were conducted an average of 11.8 d apart ( $N = 14$  interflight times, range 1–33 d) between 24 December and 9 June. When birds were located, the aircraft circled at approximately 150 m above the ground while coordinates of the relocation were determined using the airplane's LORAN navigational system. Only the bird's general movements were needed for this study so the accuracy of relocations was not determined. Habitat characteristics were not quantified at bird relocations, but general forest types were noted from the aircraft.

#### RESULTS AND DISCUSSION

Female 1 left her nest area between 26 August and 1 September, approximately 50 d after her young fledged. On 2 September she was relocated approximately 65 km south of her nest near Steamboat Springs, Colorado (Fig. 1). The bird remained in this general vicinity from 2 September to 27 October. The forest vegetation of this stop-over area was primarily aspen with scattered spruce fir and lodgepole pine groves. A snowstorm between 3–9 November that deposited approximately 28 cm of snow (Steamboat Springs, CO weather station, National Oceanic and Atmospheric Administration 1992a) apparently caused the bird to move further south. On 4 November, Female 1 was relocated approximately 70 km to the south at an elevation of 3048 m. She continued south and spent the entire winter (8 November 1992 to 12 March 1993) on forested lands between Rifle, Colorado and approximately 48 km to the east near Glenwood Springs, Colorado. The elevation of this area ranged from 2590–2960 m; the dominant forest-cover type of her wintering area was aspen with mixed conifer stands. On 12 March 1993, she was still in the Glenwood Springs area. We were unable to document her return travel route but we did relocate the bird near her 1992 nest on 23 March 1993.

Female 2 was relocated during six flights between 18 August to approximately 6 September in her nest area. On 10 September she moved approximately 6

km south into a drainage; between 10–28 September she was relocated in the same area seven additional times. On 2 October, she was relocated 28 km south of her nest, and by 14 October she was relocated in a mountain range approximately 140 km south of her nest (Fig. 1). The forest in this area was large contiguous blocks of spruce-fir and lodgepole pine stands. She was relocated during six flights in this same area through 27 October. The same snowstorm from 3–9 November that may have caused Female 1 to move south presumably also caused Female 2 to move from this mountain range. When conditions permitted, forested lands within approximately 40 km of the bird's last location were searched during three subsequent flights (4, 6, 8 November); this bird was never relocated during the remainder of the winter. On 13 March 1993, Female 2 was relocated near the Wyoming-Colorado border approximately 40 km south of her nest area. The radio signal suggested she was flying, presumably migrating back to her nesting territory. She was observed back at her nest area on 4 April.

From 18 August to 6 September, Male 1 was relocated during six flights in its immediate nest area. From 8 September through 12 October, this bird continued to associate with the nest area but the 13 relocations obtained during this period suggested his movements were more extensive, frequently ranging 5–10 km from the nest. Twelve surveys between 15 October to 25 November, indicated that Male 1 shifted his primary activity area south approximately 8 km. The forest vegetation of this use area was primarily mixed aspen and lodgepole pine. On approximately 30 November, this male began moving west southwest along a river drainage (Little Snake River) near Baggs, Wyoming (Fig. 1). From 1 December through 24 December, Male 1 was relocated during five surveys along the same drainage approximately 10 km west of Baggs, Wyoming in an area approximately 65 km from the bird's nest. Dominant vegetation along this river consisted of small groves (approximately 3 ha) of cottonwood (*Populus* spp.) surrounded by open sagebrush-wheatgrass prairies.

On 24 December, the carcass of Male 1 was recovered in open sagebrush habitat approximately 40 m from the nearest cottonwood grove. A necropsy by the Wyoming State Veterinary Laboratory, Laramie, Wyoming, revealed the bird was killed by a very hard blow from a blunt object. There was acute hemorrhaging under the right wing. Ribs on both

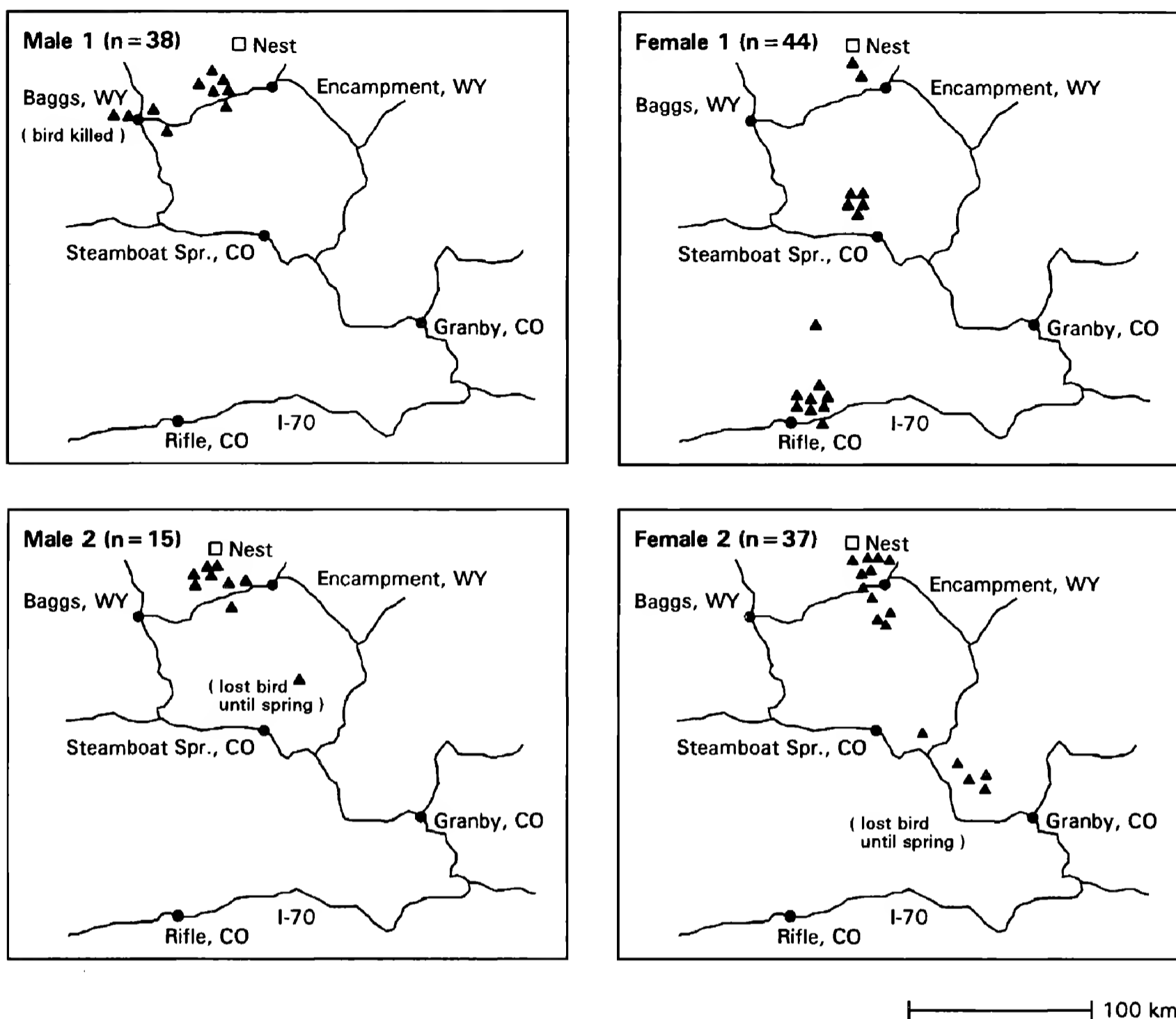


Figure 1. Winter movements of adult northern goshawks that nested (from four separate pairs) on the Medicine Bow National Forest, Wyoming ( $N$  = number of relocations,  $\blacktriangle$  = may equal more than one relocation).

sides were broken and one punctured the right ventricle of the heart. The bird's neck was also broken. Both golden eagles (*Aquila chrysaetos*) and bald eagles (*Haliaeetus leucocephalus*) are abundant in this area and peregrine falcons (*Falco peregrinus*) and gyrfalcons (*F. rusticolus*) winter in Wyoming (Wyoming Game and Fish Dept. 1992). Possibly, a strike from one of these raptors was responsible for this mortality but the carcass was not eaten and talon marks were not present. It is also possible the bird collided into the ground. There were no obstructions (trees, powerlines) in the recovery area except for sagebrush that are less than 50 cm tall.

Male 2 was relocated three times between 18–28 August in its general nest area. On 2 September, he was relocated approximately 17 km south of its nest. The next survey on 4 September was conducted in inclement weather and the bird had returned to its nest area. On 6 September, the bird was relocated 13 km south of the nest and was apparently beginning its winter migration. On 10 September, Male 2 was relocated 70 km south of its nest in a wilderness area in Colorado (Fig. 1). The bird was near a high alpine lake at an elevation of 3316 m. We were not able to locate this bird again throughout the remainder of the winter. In the spring (12 April 1993),

Male 2 was relocated approximately 10 km from the previous year's nest site and remained on the forest throughout the spring until his radio failed.

We searched extensively for the two birds (Female 2, Male 2) which we lost during their fall migration. During a 16-hr flight conducted over a 2-d period, we searched all major mountain ranges in Colorado, extending as far south as Santa Fe, New Mexico, for the lost birds. Mountain ranges were searched from an elevation of approximately 4270 m; this elevation enabled us to receive signals from approximately 80 km if the birds were approximately line-of-sight from the airplane. No birds were located during this flight. Although it is possible that the lost birds remained in northern Colorado in topography that blocked radio signals, we think this is improbable given the frequency and number of flights that were conducted over this area throughout the winter.

Results from this study suggest that goshawks nesting in southcentral Wyoming migrate during the winter. Three of the four birds migrated in a primarily southerly direction, whereas one bird migrated west southwest. Our results also indicate that goshawks begin winter movements in early fall (primarily mid-September) while weather conditions are moderate. The average high temperature during September was 22.5°C and the average nightly low was 4.6°C (Saratoga, WY weather station, National Oceanic and Atmospheric Administration 1992b). Daily high temperatures were all above 17.2°C. Precipitation only totaled 0.51 cm for the month. Two birds (Female 1, Female 2) remained in areas along their migration route for up to several weeks before continuing their southerly movements. Inclement weather may have initiated continued migratory movements since both females moved in response to the same snowstorm. All birds returned to their nests from wintering areas between 23 March and 12 April. This suggests that logging, timber marking or other forms of human disturbance, in the Rocky Mountains, should be curtailed by early spring to avoid disturbing returning birds that may be involved in courtship and nest building.

It is puzzling why Female 1 would migrate 185 km south of her nest (2500 m elevation) and then winter in Colorado at a higher elevation (2774 m). Equally high elevations are available immediately adjacent to her nest. We were unable to determine prey abundance on wintering areas and it is unknown whether prey abundance may explain the

movement patterns we observed. Further research is needed to determine the extent of winter migrations of goshawks that nest in the Rocky Mountains and to identify habitat characteristics that are important in their winter habitat selection. Although our sample size is small, these results suggest to wildlife managers that some goshawk populations in the Rocky Mountains are migratory; efforts to manage this species need to consider both wintering and nesting habitat requirements.

#### ACKNOWLEDGMENTS

We acknowledge J. Ramsey for his help trapping goshawks. We thank D. France, Rawlins, Wyoming, for providing safe and reliable monitoring flights. Support and cooperation were provided by the Rocky Mountain Region (Region 2) of the National Forest System.

#### LITERATURE CITED

- ALASKA DEPARTMENT OF FISH AND GAME DIVISION OF WILDLIFE CONSERVATION. 1993. A summary of survey, radio-telemetry, and other results regarding goshawk field studies in southeast Alaska, Ketchikan Forest Raptor Study Final Report. USDA For. Serv., Regional Office, Juneau, AK U.S.A.
- ALEXANDER, R.R., G.R. HOFFMAN AND J.M. WIRSING. 1986. Forest vegetation of the Medicine Bow National Forest in southeastern Wyoming: a habitat type classification. USDA For. Serv. Res. Paper RM-271, Rocky Mountain Forest Range Exper. Sta., Fort Collins, CO U.S.A.
- BEEBE, F.L. AND H.M. WEBSTER. 1976. North American falconry and hunting hawks. North American Falconry and Hunting Hawks, Denver, CO U.S.A.
- DOERR, P.D. AND J.H. ENDERSON. 1965. An index of abundance of the goshawk in Colorado in the winter. *Auk* 82:284-285.
- KENWARD, R.E., V. MARCSTRÖM AND M. KARLBOM. 1981. Goshawk winter ecology in Swedish pheasant habitats. *J. Wildl. Manage.* 45:397-408.
- MARCSTRÖM, V. AND R. KENWARD. 1981. Movements of wintering goshawks in Sweden. *Swedish Wildl. Res* 12:1-36.
- MARSTON, R.A. AND D.T. CLARENDON. 1988. Land system inventory of the Medicine Bow Mountains and Sierra Madre Mountains, Medicine Bow National Forest, Wyoming. USDA For. Serv. Res. Paper MBNF-88-01. Medicine Bow National Forest, Laramie, WY U.S.A.
- NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION. 1992a. Climatological Data, Colorado. Vol. 97(11).  
———. 1992b. Climatological Data, Wyoming. Vol. 101 (9-10).
- OPDAM, P., J. THISSEN, P. VERSCHUREN AND G. MÜKENS.

1977. Feeding ecology of a population of goshawk *Accipiter gentilis*. *J. Ornithol.* 118:35-51.
- ROSENFELD, R.N., AND J. BIELEFELDT. 1993. Trapping techniques for breeding Cooper's hawks. *J. Raptor Res.* 27:171-172.
- WIDÉN, P. 1985. Breeding and movements of goshawks in boreal forest in Sweden. *Holarctic Ecol.* 8:273-279.
- . 1987. Goshawk predation during winter, spring, and summer in a boreal forest area of central Sweden. *Holarctic Ecol.* 10:104-109.
- . 1989. The hunting habitats of goshawks *Accipiter gentilis* in boreal forests of central Sweden. *Ibis* 131:205-231.
- WYOMING GAME AND FISH DEPARTMENT. 1992. Wyoming bird and mammal atlas. Wyoming Game and Fish Dept., Cheyenne, WY U.S.A.

Received 13 June 1994; accepted 8 October 1994